

# **EXHIBIT 17**

**UR  
LLE**



**OMEGA**

**LASER FACILITY  
ORGANIZATION & REGULATION  
MANUAL**

**Laboratory for Laser Energetics**  
University of Rochester



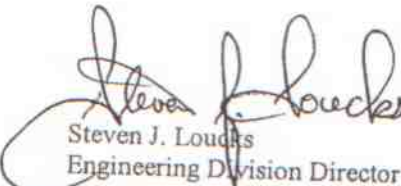


LLEINST 3000G  
31 March 2008

LLE INSTRUCTION 3000G

SUBJECT: Laser Facility Organization and Regulation Manual

1. **Purpose:** To promulgate Revision G to the policies, organization, regulations, and administrative procedures for operating the OMEGA Laser Facility.
2. **Promulgation:** Revision G to the Laser Facility Organization and Regulation Manual is hereby promulgated.
3. **Approval:**

  
Steven J. Loudts  
Engineering Division Director

UR 000090

## Record of Changes and List of Effective Pages

## Record of Changes

[illegible]

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## List of Acronyms

ALT	Alignment/Laser Technician
ASP	Alignment Sensor Package
AT	Amplifier Technician
BL	Backlighter
BO	Beamlines Operator
BWA	Blast Window Assembly
CFR	Code of Federal Regulations
CPR	Cardio-Pulmonary Resuscitation
CSO	Characterization Station Operator
CTD	Cryogenic Target Detector
CTFM	Cryogenic and Tritium Facility Manager
CTHS	Cryogenic Target Handling System
DD	Deuterium-Deuterium
DDC	Digital Direct Control
DDHPFO	DD High-Pressure Fill Operator
DER	Driver Equipment Room
DM	Deformable Mirror
DOE	Department of Energy
DPP	Distributed Phase Plate
DPR	Distributed Polarization Rotator
DT	Deuterium-Tritium
DTHPFO	DT High-Pressure Fill Operator
ECT	Experimental Cryogenic Technician
EP	Extended Performance
ESO	Experimental System Operator
EST	Experimental System Technician
FCC	Frequency Conversion Crystal
FTS	Fill and Transfer System
FTSO	Fill and Transfer System Operator
GDL	Glass Development Laser
GUI	Graphical User Interface
HED	Harmonic Energy Diagnostic
HTS	Hardware Timing System
ICF	Inertial Confinement Fusion
IR	Infrared
IRAT	Infrared Alignment Table
LARA	Large-Aperture Ring Amplifier
LDO	Laser Drivers Operator
LDT	Laser Drivers Technician
LF	Laser Facility
LFM	Laser Facility Manager
LIM	Linear Induction Motor
LON	Local Operating Network
LLE	Laboratory for Laser Energetics
LP	Long Pulse

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LSO	Laser Sources Operator
LST	Laser Sources Technician
LST-LP	Laser Sources Technician-Long Pulse
LST-SP	Laser Sources Technician-Short Pulse
MC	Moving Cryostat
MCTC	Moving Cryostat Transfer Cart
NLUF	National Laser Users' Facility
NNSA	National Nuclear Security Administration
OAP	Off-Axis Parabola
OAPI	Off-Axis Parabola Inserter
OOC	Out-of-Commission
OSHA	Occupational Safety and Health Administration
OSO	OMEGA Scrubber Operator
PC	Personal Computer
PCO	Power Conditioning Operator
PCT	Power Conditioning Technician
PCU	Power Conditioning Unit
PEPC	Plasma-Electrode Pockels Cell
PGR	Pulse Generation Room
PI	Principal Investigator
PLC	Programmable Logic Controller
PMA	Periscope Mirror Assembly
PT	Photographic Technician
SAD	Safety Analysis Document
SD	Shot Director
SP	Short Pulse
SRF	Shot Request Form
SSD	Smoothing by Spectral Dispersion
SSG	Small Signal Gain
SSP	Stockpile Stewardship Program
SVS	Shroud Viewing System
T	Ton
TCTRSO	Target Chamber Tritium Removal System Operator
TED	Target Existence Detector
TFSO	Tritium Fill Station Operator
TIM	Ten-Inch Manipulator
TRS	Tritium Removal System
TTO	Target Transfer Operator
UR/LLE	University of Rochester/Laboratory for Laser Energetics
UV	Ultraviolet
UVAT	Ultraviolet Alignment Table
XRFC	X-Ray Framing Camera

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**1000 Laser Facility Overview**

OMEGA is a multikilojoule-class laser facility located at the University of Rochester's Laboratory for Laser Energetics (UR/LLE). The OMEGA Laser Facility includes the 60-beam compression laser system, the four-beam extended performance (EP) laser, and the cryogenic target handling system. The laser systems can be operated independently, with separate scientific objectives for each, or jointly with the combined capabilities addressing a single requirement.

The OMEGA compression laser system is a 60-beam neodymium glass laser that is frequency converted to deliver up to 30 kJ of 351-nm light on target. This system is capable of conducting fully diagnosed direct-drive or indirect-drive target physics experiments, including direct-drive planar or spherical cryogenic experiments. The system is designed to operate on a 1-h shot cycle and will nominally deliver 1000 shots per year in single-shift operations.

The OMEGA EP Laser System consists of four beams, two that have both long- and short-pulse capability and two that have only long-pulse capability. The short-pulse beams deliver 1- to 100-ps pulses at energies up to 2.6 kJ per beam to either the OMEGA compression target chamber or the auxiliary OMEGA EP target chamber. The long-pulse beams deliver 1- to 10-ns pulses at energies up to 6.5 kJ per beam to the auxiliary OMEGA EP target chamber. When coupled to the OMEGA target chamber, the OMEGA EP system will support short-pulse backlighting and fast-ignition experiments. When coupled to the auxiliary target chamber, the system will be capable of fully diagnosed high-energy, high-intensity planar experiments. The system is designed to operate on a 2-h shot cycle and will nominally deliver 450 shots per year in single-shift operations.

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The OMEGA Cryogenic Target Handling System (CTHS) is capable of filling, layering, and characterizing cryogenic DD and DT spherical targets and DD planar targets. It delivers and positions these targets in the target chamber and supports them at the target chamber center until they are shot. The OMEGA EP system will be limited to planar DD targets.

The OMEGA Laser Facility is funded by the Department of Energy (DOE) and is housed in the University of Rochester-owned Laboratory for Laser Energetics' facility located on the South Campus of the University of Rochester. The facility is operated under a Cooperative Agreement between the Department of Energy and UR/LLE. Under this Agreement the UR/LLE also operates the National Laser Users' Facility (NLUF). Shots are made available to NLUF users on the OMEGA Laser Facility; however, the NLUF users are funded by DOE outside of the DOE-UR/LLE Cooperative Agreement.

## 1001 OMEGA Governance Plan

## 1.1 Introduction

The OMEGA Governance Plan covers the process by which the OMEGA Laser Facility, including OMEGA EP, will be governed to determine the allocation of system time, schedule user experiments, and ensure that users' current and future requirements are presented to the OMEGA Facility Director. This governance plan does not cover the line-management functions of the OMEGA Facility Director to operate and maintain OMEGA and OMEGA EP. The organization for OMEGA Governance is outlined in Fig. I-1.

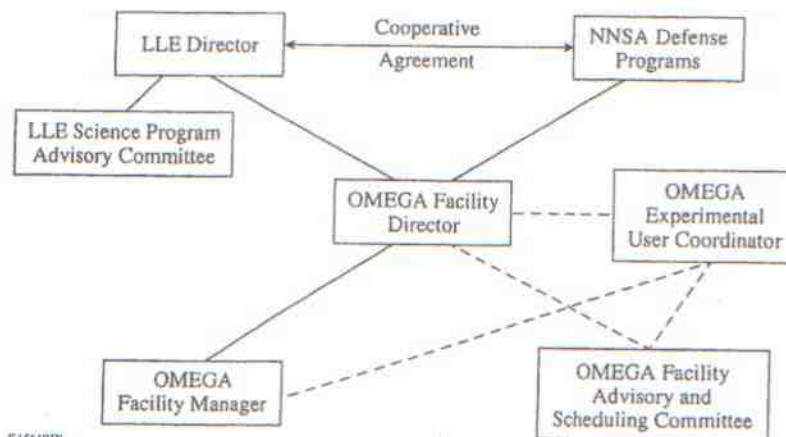


Figure I-1

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The LLE Director is responsible for the overall direction of the laboratory to ensure that National Nuclear Security Administration (NNSA) program goals are supported. He is responsible for appointing the OMEGA Facility Director,

- The LLE Director is selected by the President and approved by the Board of Trustees of the University of Rochester in consultation with NNSA and is appointed for a five-year renewable term.
- The LLE Director reports administratively to the University of Rochester's Provost. Programmatically, the LLE Director consults with the NNSA Assistant Deputy Administrator Office for Inertial Confinement Fusion.
- The LLE Director approves and publishes the annual OMEGA fiscal-year shot schedule three months prior to the start of the fiscal year and certifies that it fulfills the guidance provided by NNSA.

**1.1.2 OMEGA Facility Director**

The OMEGA Facility Director is responsible for defining the overall OMEGA facility use that maximizes the benefit to the national stockpile stewardship and ignition programs and balances security priorities with broader scientific, technological, and economic competitiveness goals.

**1.1.3 OMEGA Facility Advisory and Scheduling Committee (FASC)**

This committee recommends OMEGA system time allocation, promotes an effective user community, and reviews the facility's overall effectiveness for users.

**1.1.4 LLE Science Program Advisory Committee**

This committee advises the LLE Director on major policy issues, balance of program use, use strategy, availability, and future capabilities of OMEGA. It advises on LLE's ICF science program direction.

**1.1.5 OMEGA Experimental User Coordinator**

The Experimental Coordinator is the single point of contact for all non-LLE Principal Investigators (PI's). He/she is the liaison between the PI and the OMEGA support staff for technical information and user support for planning and conducting experiments on OMEGA. The user coordinator is appointed by the Experimental Division Director

**1.1.6 OMEGA Laser Facility Manager**

The OMEGA Laser Facility Manager is responsible for the overall operation and operational readiness of the OMEGA Laser System, including the OMEGA compression and OMEGA EP facilities.

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## 1.2 OMEGA System Time Availability, Programmatic Allocation, and User Support

### 1.2.1 System Time Availability

There are three principal uses of OMEGA: ignition physics, weapons physics, and basic science. The allocation of system shot time to users will be based on NNSA's programmatic needs and available shot time. The number of shots depends on the type of shots, system availability, experimental effectiveness, and funding levels.

The OMEGA Laser Facility Manager is responsible for the overall operation of OMEGA, including ensuring that system availability and experimental effectiveness are optimized. The Laser Facility Manager will provide the following to the OMEGA Facility Director, the OMEGA Facility Advisory and Scheduling Committee, and the LLE Science Program Advisory Committee:

- Monthly report on the number of target shots scheduled and completed by user, including the experimental effectiveness of each shot. A yearly summary report will be provided.
- Monthly report of OMEGA system availability, including an analysis of the contributions to system nonavailability. A yearly summary report will be provided.
- An annual projection of the system time available based on the expected funding.

### 1.2.2 Programmatic Allocation

The OMEGA Facility Advisory and Scheduling Committee (FASC) will recommend system time allocations as described in Sec. 1003 following guidance on program balance. In FY08 the system time allocation was 50% for the National Ignition Campaign (NIC), 20% for weapons physics, 25% for basic science (NLUF and Laboratory), and 5% contingency. Contingency will be assigned to make up system time lost due to unavailability and/or for additional urgent requirements. The FASC will advise the LLE Director and OMEGA Facility Director on changes to the guidance for program balance.

### 1.2.3 OMEGA User Support

The OMEGA Facility Director has fiscal responsibility for operation of the facility and is responsible for ensuring that all appropriate support functions are provided. Standard capabilities required for users to conduct experiments supplied by the facility include:

- Experimental support, including facility diagnostics, operations data processing and access, standard phase plates, and polarization rotators. An on-site target contractor provides support for national laboratories and

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NLUF users; however, targets are not supplied and are the responsibility of the user.

- Administrative support including badging, safety training, facility orientation, data archiving and retrieval, Shot Request Form (SRF) administration and preparation assistance, working areas and logistic support, and computer network connections.
- Engineering support to field/adapt user-supplied diagnostics.
- Technical information and support for planning and conducting user experiments.

**1002 Science Program Advisory Committee**

The LLE's Science Program Advisory Committee advises the LLE Director on significant policy matters relating to LLE's scientific program and OMEGA's use and capabilities planning. The organization of this committee is shown in Fig. 1-2; its chairman is appointed by the Laboratory Director. Its specific responsibilities include the following:

- Make recommendations to the OMEGA Facility Advisory and Scheduling Committee as to LLE experiments to be performed and their relative priorities.
- Formulate LLE's annual Work Plan.
- Formulate and maintain up-to-date long-range program plans of five and ten years.
- Advise on major changes to the overall balance of facility use that may be required.
- Recommend actions needed to resolve issues of inadequate system time or financial resources to meet programmatic requirements.
- Recommend policy with respect to international collaboration and use of OMEGA.
- Review major proposals that significantly add or change facility capabilities and advise on the merits of such additions or changes relative to cost (including the cost of the system time).
- Brief or provide a written report of its recommendations to the LLE Director and other LLE Division Directors. If a consensus view is not reached within the committee, all views will be represented.
- Develop LLE's Annual Self-Assessment.

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## OMEGA Scientific Program Advisory Committee

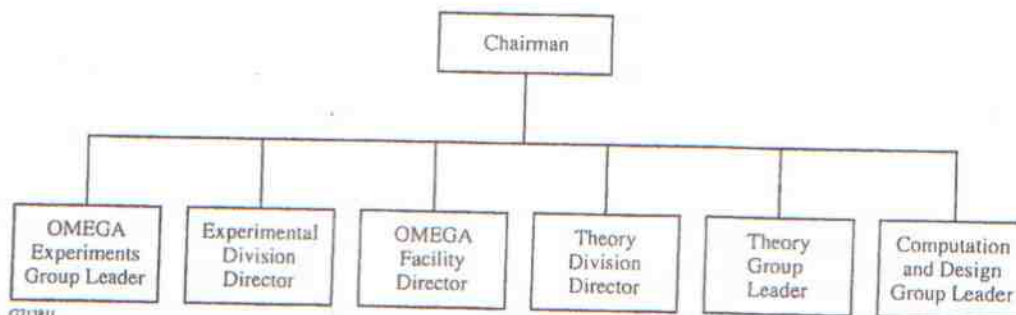


Figure I-2

## 1003 FASC Roles and Responsibilities

## 3.1 Responsibilities

The Facility Advisory and Scheduling Committee formulates the annual facility schedule, reviews experimental proposals for compatibility and safety, and evaluates facility availability and experimental effectiveness. The FASC recommends the annual facility schedule and represents the needs of the users to the LLE Director and OMEGA Facility Director.

## 3.1.1 Annual Scheduling Meeting

The full FASC meets in June of each year to formulate the one-year OMEGA facility schedule for the upcoming fiscal year. Additionally, the FASC reviews facility availability and effectiveness for the previous year and recommends notional shot allocations for the fiscal year after next. Specific responsibilities include:

- Recommend shot allocations for the set of experimental proposals submitted by the OMEGA user groups for the upcoming fiscal year using the following criteria:
  - Consistency of experimental goals and NNSA's programmatic requirements and the likelihood of the experimental goals being achieved.
  - The uniqueness of OMEGA to perform the experiment or a recommendation that the experiment be performed by another facility.
  - The impact of the experiment on the facility, e.g., potential for system damage, environmental issues, etc.

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- Review programmatic requirements for the fiscal year after next and make a recommendation for total system time required and the overall program balance.
- Review user requests for facility modifications and recommend appropriate action to the LLE Director and OMEGA Facility Director.
- Review the OMEGA availability and experimental effectiveness for the past year and recommend appropriate lessons learned to the LLE Director and OMEGA Facility Director.
- Review existing experimental capabilities such as diagnostics and information availability, and recommend improvements where warranted.
- Review policy for experimental data ownership, access, and security issues.

**3.1.1.1 Membership** The FASC committee members are appointed by the host institution and approved by the LLE Director. The membership is summarized below.

Number of Members	Subcommittee	Source
8	Ignition Physics	LLNL, LANL, LLE (5), SNL
2	Weapons Physics	LLNL, LANL
2	Basic Science	NLUF Manager (1) University Community (1)

The committee membership will serve for a term determined by the host institution. The term should nominally be for at least two years. The committee chairman will be the Deputy Director of LLE or another member appointed by the LLE Director.

The basic science subcommittee consists of the NLUF manager and a representative of the university users' committee appointed by the LLE Director. Basic science consists of the NLUF and Laboratory basic science programs. Laboratory means the National Laboratories (LLNL, LANL, and SNL) and LLE (including the Fusion Science Center represented through LLE). An NLUF Technical Evaluation Panel is appointed separately as defined by the NLUF management program contained in the UR/LLE-DOE Cooperative Agreement. This committee meets biennially to review NLUF proposals and recommends to NNSA the proposals to fund and their shot allocations. The recommendations of this committee are represented by the NLUF Manager at the FASC. While the NLUF programmatic funding is provided separately by NNSA, the programmatic funding for Laboratory basic

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science is provided by the individual laboratory and system time is provided by the facility. The Laboratory basic science program will be administered by the NLUF Manager who will issue a yearly solicitation for proposals. The Laboratory Basic Science Review Committee members will be approved by the LLE Director and will consist of members from the user laboratories (one each) as well as at least two independent members. This committee will peer review all proposals on merit and make a recommendation to the LLE Director of proposals in rank order including a recommended system time allocation.

**3.1.1.2 Committee Procedures** The procedures that govern the annual schedule formulation process and facility review are outlined in this section. This process will be initiated each year by the OMEGA Facility Director issuing relevant guidance and a planning timeline.

- The subcommittees meet in the early spring to review proposals and recommend system time requirements in time to provide an input to the draft annual facility schedule and support the annual FASC meeting held in June of each year.
- The OMEGA Facility Director collects the inputs from the subcommittees, evaluates facility impact, and formulates a draft of the fiscal-year schedule for review at the annual FASC meeting. The subcommittee chairman will present proposals for system time to the FASC, including the results of proposal ranking and recommending experiments that should be scheduled.
- The full committee will meet in closed session to evaluate the input of the subcommittees and recommend a balanced program that meets the guidance provided by NNSA. If there is inadequate system time to fulfill all requests, the committee will recommend the "split" among the three areas and require the subcommittees to reduce the requests to meet the allocation. The full committee will recommend the fiscal-year schedule that includes 5% contingency to the LLE Director for approval.
- The committee will complete the reviews identified in Sec. 3.1.1 and report the results to the LLE Director and OMEGA Facility Director.

**3.1.1.3 User Requirements** Each laboratory is responsible for formulating an experimental program to fulfill its campaign objectives. Proposals for experiments from selected PI's are formulated to meet these program objectives. Proposals that are not in support of program objectives should not be submitted. Members of participating laboratories cannot be PI's on NLUF proposals. Proposals from outside entities [for example, proposals resulting from international agreements (e.g., CEA, AWE)], will go through the same

process as all other proposals. Proposal content and PI responsibilities are detailed in Sec. 1004.

### **3.1.2 Fiscal Year After Next First-Quarter Schedule**

A provisional first-quarter schedule will be developed in April of each year. The planning for this will be initiated by LLE at least two months in advance, and the scheduling meeting will be via video teleconference. This will allow the identification of target requirements early to ensure that first-quarter experiments can be supported. While this schedule is provisional, it is envisioned that it will be adopted with little or no revision during the normal annual June OMEGA Scheduling and Advisory Committee meeting. The recommended notional system time allocations for the upcoming fiscal year should be used as guidance in arriving at this provisional first-quarter schedule. Section 3.1.1 procedures should be used in developing this schedule.

### **3.1.3 Biweekly FASC Meetings**

A subcommittee of the FASC consisting of the LLE members of the FASC, the Laser Facility Manager, the Experimental Operations Group Leader, and the Laser System Scientist meet biweekly to administer the facility schedule and monitor its effectiveness (other, non-LLE committee members are welcome to attend this meeting if available on site). Specific responsibilities include:

- Review experimental proposals submitted by Principal Investigators two months in advance for system and experimental compatibility and safety. Approve or recommend changes to the proposals.
- Review experimental critiques submitted by Principal Investigators and propose corrective actions to the Facility Director where warranted.
- Evaluate the current and planned activities on the system presented by the Laser Facility Manager.
- Evaluate the experimental diagnostic performance and progress in implementing new/modified diagnostics presented by the Experimental Operations Group Leader.
- Review the status of submitted proposals and critiques.
- Review recommended schedule changes and, in consultation with users, formulate schedule changes to accommodate user requests where possible.
- Assign system contingency time to make up for lost experimental time or to perform new, high-priority experiments.

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- Conduct a running review of the system schedule to determine the ability to perform previously approved experiments, especially those dependent on system or diagnostic upgrades.
- Ensure that the facility schedule is kept current and posted on LLE's web site.

#### 1004 Experimental Proposals and Principal Investigator Roles and Responsibilities

With respect to the laser facility, PI's are those individuals responsible for proposing experiments to be conducted on the OMEGA Laser System.

##### 4.1 Principal Investigator Orientation

Principal investigators must complete an OMEGA familiarization before conducting their first experiment. This familiarization should be scheduled through the Laser Facility Manager at least three months prior to the PI's first scheduled experiment. The familiarization will include the following:

- Briefing on OMEGA and/or OMEGA EP capabilities,
- Review of PI responsibilities including SRF preparation,
- Safety briefing,
- Tour of OMEGA/OMEGA EP,
- Observation of operations, preferably with an experimental PI,
- Target metrology and positioning requirements, and
- Briefing on diagnostic qualification procedures.

##### 4.2 Experimental Proposal

Once an experiment is scheduled by the FASC, the PI is responsible for submitting a proposal template and SRF's, coordinating experimental and laser requirements, monitoring the experiment execution, and writing a critique of the execution of the experiment within one week of its performance. Principal investigators are responsible for submitting an electronically transmitted experiment proposal template to the FASC that amplifies and extends the information submitted prior to scheduling the experiment. This template and accompanying SRF's, target request forms (TRF's), and VISRAD files must be received at least two months prior to the conduct of the experiment and will initiate the preparation phase for the experiment.

##### 4.2.1 Proposal Template Instructions

4.2.1.1 Date of experiment, AM or PM, experiment title, principal investigators names, and applicable facility (OMEGA, OMEGA EP, or both)

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## 4.2.1.2 Summary of the experiment's objectives

4.2.1.3 Laser and diagnostic requirements for the experiment. The input for this should include experimental configuration name and a draft SRF and a request identification (RID) number for each experimental configuration. Any non-LLE supported diagnostics or unqualified diagnostics should be separately identified.

## 4.2.1.4 Type and number of targets including number of spares.

- Identify the target request form (TRF) number for each configuration, if available.
- A sample of complex targets (defined as other than a simple flat-foil, spherical direct-drive capsule, or plain hohlraum) must be delivered to LLE at least one week prior to the scheduled experiment. This will allow testing the positioning of the target and developing accurate target-positioning procedures and reticules by placing the target at target chamber center (TCC) when TCC time is available. Indicate on the proposal if targets are complex and include the number of targets ordered for each configuration.
- Targets must be metrologized prior to delivery to LLE and verified after arrival at LLE using LLE's Powel scope. Metrology data will be available to the Experimental Operations Group no later than two full working days prior to the day of shots.

4.2.1.5 A VISRAD file that shows the target including the mount stalks and the beams intercepting the target. (Use of the software program, VISRAD, enhances visualization and importation of data to the SRF.) The file name must be formatted "<RID Number>-<PI Name>.vvw," e.g. for targets corresponding to RID 12345 and PI surname of Heeter, the file name is "12345-Heeter.vvw." VISRAD files must be submitted as attachments to the proposal.

## 4.2.1.6 Quantity (shot count) of target shots proposed.

4.2.1.7 Identification of diagnostics planned for use on the experiment that are not qualified for use on OMEGA/OMEGA EP. Non-qualified diagnostics are those that have not completed facility qualification per LLE Instruction 7700 and are not generally selectable on the SRF.

## 4.2.1.8 Laser-energy transport considerations (OMEGA only)

- A. Estimated laser-energy transmission through target:  
Significant transmission of laser light through a target can cause damage to the opposed beam optics of the OMEGA compression facility. A beam transmitted through an underdense target can have

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significant spatial modulation. The potential for such damage is increased when a distributed phase plate is used in a beam. To assess the potential for such damage, the PI is required to state the estimated level of laser-beam transmission through the target (including blow-through) for the proposed experimental configuration. The basis of this estimate can be a simulation of the laser-target interaction or data from an experiment that closely simulates the proposed experimental configuration. No experiment will be approved unless such an estimate is provided in the template submitted for approval to the OMEGA FASC two months prior to the scheduled shot day. Beam dumps or calorimeters can be installed in opposing beams to increase the maximum acceptable energy transmission (for up to six beams). The following matrix shows the maximum allowable blow-through under various scenarios:

DPP in either target or opposing beam?	Beam block (in opposing beam?)	Maximum acceptable energy transmission
Yes	No	20 J
Yes	Yes	200 J
No	No	100 J
No	Yes	300 J

- B. Estimated laser-energy backscatter from the target  
Significant backscatter from a target can cause damage to the beamline optics. To prevent damage, the estimated backscatter energy must not exceed 140 J.
- C. Estimated laser energy reflected from the target  
Significant laser energy reflected from a flat target can be directed into other beam ports and damage beamline optics. To reduce the reflected energy and prevent damage, the maximum angle of incidence of a laser beam on a flat target must not exceed 65°.

#### 4.2.1.9 Special shot-schedule considerations associated with experiment

4.2.1.10 Campaign configuration variables. Include all shot parameters such as pulse shapes, beam energies, beam delays, diagnostic setup, etc. that will be varied during the campaign.

4.2.2 The proposal template (see Table I-1) will be reviewed by the FASC to ensure that the experiment's requirements are consistent with the capabilities of the Laser Facility.

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## Experiment Proposal Template (Table I-1)

4.2.1.1 General:		Date of Experiment:		<input type="checkbox"/> AM <input type="checkbox"/> PM	
		A. Experiment Title:			
		B. Principle Investigators:			
		C. Facility: <input type="checkbox"/> OMEGA <input type="checkbox"/> OMEGA EP			
4.2.1.2 Summary of Experiment Objectives:					
Experimental Specifications and Laser/Diagnostic Requirements:					
4.2.1.3 SRF		4.2.1.4 Targets		4.2.1.5 VISRAD Filename (RID-PI Name.vrw) (Submit files with proposal)	
Experimental Configuration Name	Example RID #	TRF #	Complex Yes No	Quantity	4.2.1.6 # of Target Shots
			<input type="checkbox"/> <input type="checkbox"/>		
			<input type="checkbox"/> <input type="checkbox"/>		
			<input type="checkbox"/> <input type="checkbox"/>		
			<input type="checkbox"/> <input type="checkbox"/>		
			<input type="checkbox"/> <input type="checkbox"/>		
4.2.1.7 Identify all diagnostics required that are not qualified					
Diagnostic Name			Description		
4.2.1.8 Energy Transport Considerations					
A. Estimated laser transmission through target (OMEGA only): <input type="checkbox"/> J					
B. Estimated backscatter energy is less than 140 J <input type="checkbox"/>					
C. For flat targets, verify maximum angle of incidence is less than 65° <input type="checkbox"/>					
4.2.1.9 Special considerations:					
4.2.1.10 Campaign configuration variables:					

**4.3 Principal Investigator Responsibilities**

Once the principal investigator's experiment has been scheduled, it will become the PI's responsibility to interface (via the Experimental Division liaison representative for user experiments) with the assigned experimental coordinator, and ultimately with the Laser Facility Manager, the Experimental Operations Group, the Optomechanical System Group, and the LLE Target Fabrication Group (while keeping the experimental coordinator and liaison representative informed) to ensure that the experimental and laser system requirements are coordinated and understood (see Fig. I-3). If a principal investigator uses targets and/or diagnostics not provided by LLE resources, or requires a pulse shape that is not in the LLE inventory, the PI must coordinate those respective requirements through the corresponding LLE groups to ensure that, at the time the experiment is to be conducted, issues associated with availability or compatibility of those non-LLE-provided resources have been resolved.

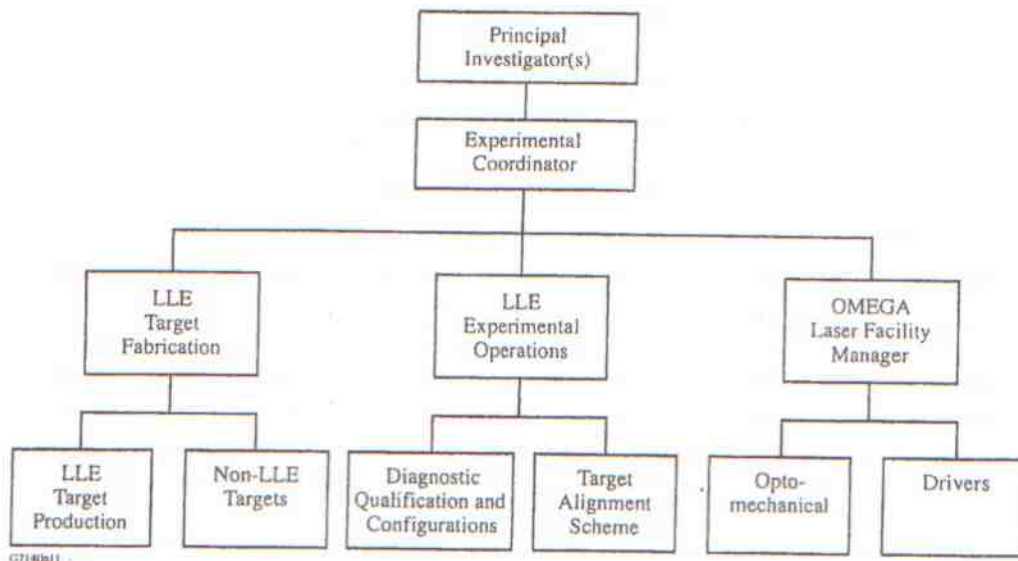


Figure I-3

**4.3.1 Experiment Reviews**

**4.3.1.1** Approximately two weeks prior to commencing the experiment, the PI, or designee, will conduct a comprehensive review of the detailed requirements for their upcoming campaign. This review is for the mutual benefit of the laser and experimental operations group leaders and the scientists involved with laser and diagnostic systems. If changes have been

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made since the two month submission, the PI shall submit an updated VISRAD model of the targets and revised SRF's that define each unique shot configuration prior to this meeting. (See Sec. 4010 "Shot Request Forms and Administration" for more on the forms.)

**4.3.1.2** All new diagnostics must be fully qualified by Wednesday, two weeks before the date of the experiment.

**4.1.1.3** Final Shot Request Forms shall be submitted to the Laser Facility Manager by the close of business on the Monday prior to the week of target shots. The Laser Facility Manager shall be notified of subsequent changes prior to the initiation of the shot by the operations crew. Any special requirements for set up of the diagnostics for the first shot should be clearly indicated: for example, modifications to the ten-inch manipulator set-up sheets.

**4.3.1.4** By two working days before the shots, the PI will provide target metrology results for all targets to the Experimental Operations Group Leader.

**4.3.1.5** For each shot day of the campaign, the PI will support the shift briefings as appropriate. During the actual execution of the experiments, the principal investigator will act as an advisor to the LLE Shot Director and may be called upon to render advice on whether to proceed with planned experiments in the event of abnormal system performance. The Shot Director is in charge of the overall laser and target systems during a shot series. If issues associated with safety (personnel or equipment) arise during an experimental sequence, the Shot Director can abort that shot or even the whole series if warranted.

#### **4.3.2 Experiment Critiques**

Once the experiment (or sub-series of the experiment) has been conducted, it is the responsibility of the principal investigator to provide to the FASC [within one week after the experiment (or sub-series) has been conducted] a written critique of the performance of the experiment and facility. The following items should be included:

- Problems encountered
  - Laser
  - Experimental diagnostics
  - Experimental
  - Target
- Suggestions for improvements
- Positive feedback

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Standard Operating Procedures

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4001	Control Room Access and Formality
4002	Room 157 Access and Formality
4003	Control of Maintenance
4004	Equipment Status Log
4005	Tagout/Lockout
4006	Target Chamber Entry
4007	Grating Compression Chamber Entry
4008	Safety
4009	Communication Procedures
4010	Shot Request Form and Administration

**4000 Procedural Compliance**

The Safety Analysis Documents (SAD) for OMEGA and the Environmental Assessment for OMEGA EP identify the safety hazards and how they are mitigated by design, interlock, and procedure. Of the hazards reviewed, protection from personnel exposure to hazardous levels of laser and nuclear radiation and high voltage requires that no personnel are in the hazardous areas during target shot operations. To assure that no personnel remain in hazardous areas upon establishing "closed access" as well as the need to avoid the potential for significant equipment damage dictates the need for formal compliance with approved operational procedures.

In the context of operating the OMEGA Laser Facility, including the tritium facility, the CTHS, and OMEGA EP, formal procedural compliance means:

Only formally approved written procedures will be used to conduct shot and tritium operations. These procedures are contained in the applicable Operations Procedures Manuals for OMEGA, Volume II; CTHS, Volume V; and OMEGA EP, Volumes VIII and IX.

If an error or omission that prevents continuing is noted in an Operation Procedure, the system will be placed in a safe state and the operation will be halted until a formal written change to the procedure is approved by the Laser Facility Manager or Cryogenic and Tritium Facility Manager (CTFM) as applicable.

The System Operation Procedures will be referenced as required during operations. For Shot and Tritium Operations, the applicable procedures will be open and used as a check list by the Shot Director, Control Room, and CTHS Operators. For all other evolutions, e.g., system preoperational checks and startup, system shutdown, and maintenance operations, the procedure will be referenced as frequently as necessary to ensure compliance with the procedural requirements.

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**4001 Control Room Access and Formality**

The Control Rooms are the central control station for the operation of OMEGA and OMEGA EP. To ensure the safe and proper operation of the facility, the atmosphere in the Control Room must be formal and businesslike. To ensure that the desired level of formality is maintained, the following will be enforced:

- Access will be restricted to those who have a need to be there and will be strictly controlled by the Shot Director. During periods of power conditioning unit charging, as indicated by the flashing "closed access" signs outside the Control Room, no entry will be allowed.

- No impromptu meetings or gatherings will take place in the Control Room.

- No eating will be allowed in the Control Room.

- No reading of unofficial or non-work-related material will be allowed.

**4002 Room 157 Access and Formality**

All operations for filling warm DT and cryogenic DD/DT targets occur within Room 157. To ensure the safe and proper operation of the tritium and cryogenic facility, the atmosphere within the facility must be formal and businesslike. This is especially true whenever tritium operations are taking place; that is, whenever the tritium is removed from the uranium getters or a contaminated system is opened. The following will be enforced at all times:

- No impromptu meetings or gatherings will take place.

- No eating or drinking will be allowed at any time.

- No reading of unofficial or non-work-related material will be allowed (at all times).

The following additional requirements will be enforced during tritium operations:

- Only personnel qualified as Radiation Workers will be allowed access.

- Only CTHS operators and relevant supervisors will be allowed access.

- All personnel within the facility will wear laboratory coats.

**4003 Control of Maintenance**

Maintenance must be controlled to ensure the readiness of the Laser or Tritium and Cryogenic Facility to conduct shot or target operations respectively. Additionally, this is required to determine the applicable post-maintenance inspections and tests that must be completed. Accordingly, the following procedures will be followed:

- The approval of the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, must be obtained prior to performing maintenance on or removing a system, subsystem, diagnostic, or equipment from service that is required to support scheduled shot or target operations.

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The Shot Directors for OMEGA and OMEGA EP and the Cryogenic and Tritium Facility Manager will maintain an Equipment Status Log to document systems, subsystems, diagnostics, or equipment placed out of commission or in reduced status.

Corrective and preventive maintenance will be scheduled by the individual work centers in consonance with the applicable facility's operating schedule.

The completion of maintenance and the restoration of systems, subsystems, diagnostics, or equipment to service will be reported to the Shot Director or Cryogenic and Tritium Facility Manager as applicable.

**4004 Equipment Status Log**

The Shot Directors and Cryogenic and Tritium Facility Manager (CTFM) will maintain an Equipment Status Log during both Watch Condition 1 and 2. This log shall document the current out-of-commission status of systems, subsystems, diagnostics, or equipment and the completion of required preoperational tests and inspections prior to shot operations. This log will be maintained in the Control Room for OMEGA and OMEGA EP and in Room 157 for the tritium and cryogenic facility and will be maintained in two sections as follows:

Out-of-Commission (OOC) List: This section will be a chronological listing of systems, subsystems, diagnostics, or equipment placed out of commission and will indicate the current OOC status. This list will be in the following format (Fig. IV-1 is a representative log sheet):

Time/Date Placed OOC	System, Diagnostic, or Equipment	Tagout, if required		Post Test		Time/Date Restored	SD/CTFM Initial Here
		Enter Next Number	Date Cleared	Enter Y/N	Date Completed		

Before restoring a system, diagnostic, or equipment and signing the time/date restored block, the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, will ensure that both the tagout and post-test requirements, as applicable, are completed.

Material Deficiency Lists: This section will be a listing of material deficiencies that do not place a system, subsystem, diagnostic, or equipment out of commission, but require documentation to ensure operator awareness and subsequent correction. The material deficiency lists will be segregated by work center (Controls, Experimental Operations, Laser Amplifiers, Laser Drivers, Laser Optomechanical, Optics, and Cryogenic and Tritium Facility) and will be in the following format:

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Time/Date Identified	Entered by	System, Diagnostic, or Equipment	Time/Date Restored

Work center supervisors shall review their section of the material deficiency lists at least weekly to ascertain new items and update those that have been corrected. The material deficiency lists will be recopied monthly to eliminate items that have been corrected.

**4005 Tagout/Lockout**

To ensure personnel safety and to prevent equipment damage, positive procedures are required to prevent the inadvertent operation of systems or equipment placed out of commission for maintenance. Of particular concern is the risk of electrical shock, exposure to harmful laser radiation, release of the stored energy from pressurized compressible fluids, or the release of toxic chemicals. As a facility becomes larger and more and more people become involved in the operation and maintenance of the same systems and equipment, reliance on a "single" cognizant person for his or her safety can no longer be assumed. Accordingly, it becomes increasingly likely that a breaker, switch, or valve will be inadvertently operated by an operator who is either careless or unaware of a system's maintenance status. Such actions can result in the personal injury or death (e.g., electrocution or entrapment by rotating equipment) of personnel performing maintenance or in the destruction of equipment (e.g., starting a pump without oil). Accordingly, formal procedures are required to prevent the inadvertent operation of systems or equipment placed out of commission for maintenance.

As used in this procedure a tagout is defined as the placement of a tag on a breaker, switch, control device, or valve that states that it should not be operated. Lockout is defined as the installation of a physical barrier to operation such as a lock or the removal of a connecting link to prevent operation of the component being worked on.

The following policies apply to utilizing the tagout/lockout procedures described herein:

Each supervisor and maintenance technician will evaluate each maintenance action with respect to safety and the need to utilize these tagout/lockout procedures. If there is a risk of someone inadvertently operating a system opened for maintenance, appropriate breakers, switches, control devices, and/or valves will be tagged in the safe position by a red "DANGER DO NOT OPERATE" tag (as shown on p. IV-5) or will be physically locked to preclude operation. The Shot Director will be responsible for ensuring that these tagout/lockout procedures are used when appropriate prior to allowing maintenance to take place.

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<b>DANGER DO NOT OPERATE</b>	
Tag No. _____	Required Position _____
Equipment ID _____	
Breaker/Valve ID _____	
Posted (Hung) by _____	
(Signature) _____	/ _____ (time and date)
Reason for Tag: _____	

Breakers, switches, valves, etc., that are tagged will be verified by personal inspection to be in the appropriate position prior to hanging a "DANGER DO NOT OPERATE" tag. These tags will be securely affixed to the actual breaker, switch, or valve in a manner that ensures their visibility to anyone who might operate it. After the tag is hung, it will be signed by the person hanging it. Breakers and switches will be verified by observing their position relative to local on/off markings. Valves will be verified either by position indicators or physically verifying the valve by turning in the direction of the desired position.

The tag(s) shall be removed when maintenance is completed and the system or equipment is ready to be restored to service or operated for testing.

Under no circumstances will a breaker, switch, or valve that is tagged by a "DANGER DO NOT OPERATE" tag be operated.

Particular attention must be paid to systems or equipment that either has more than one source of power or is remotely controlled.

All electrical power systems containing >24 volts will be de-energized prior to performing maintenance, unless the procedures of Sec. 4008 for working on energized components are employed. Tags will be used for protection on systems with voltages from 120 to <440 volts. Physical lockout will be used for protection on systems with a voltage of  $\geq 440$  volts.

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A Tagout Log consisting of a tagout index and individual tagout sheets will be maintained in the OMEGA and OMEGA EP Control Rooms by the respective Shot Director or in Room 157 by the Cryogenic and Tritium Facility Manager and will be administered as follows:

The Out-of-Commission List of the Equipment Status Log (Fig. IV-1) will serve a dual purpose as the tagout index. When a tagout is indicated as necessary, a sequential tagout number will be assigned and entered in the space provided.

An individual tagout sheet (Fig. IV-2) will be filled out for each individual system, subsystem, diagnostic, or equipment that requires a tagout. After the tagout sheet is completed by the maintenance person, the adequacy of the tagout coverage will be verified by the Shot Director or Cryogenic and Tritium Facility Manager as applicable who will indicate his/her authorization by signing the tagout sheet.

Once the tagout is authorized, the maintenance person will position the device, install the tags, and when all tags are installed, he/she will sign the tagout sheet; maintenance may then be started.

When maintenance and required preoperational inspections are completed, the maintenance person will remove the tags that were hung to support the maintenance. All tags removed will be delivered to the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, and the maintenance person will sign the tagout sheet to indicate the tags have been removed.

The Shot Director or Cryogenic and Tritium Facility Manager as applicable will check that all tags listed on the tagout sheet have been returned. He/she will then remove the respective tagout sheet from the active section of the tagout log and place it in the inactive section of the log. If no Post Test is required, the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, will also update the Out-of-Commission List by indicating the date the equipment was restored to service.

When a Post Test is completed after removal of the tags, the maintenance person will review the results with the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, and certify that the equipment may be restored to service. The Shot Director/Cryogenic and Tritium Facility Manager will then update the Out-of-Commission List by indicating the date the equipment was restored to service.

An **audit** of the Tagout Log will be conducted weekly as follows:

Check the OOC List/Tagout Index against the Active Tagout Sheets to ensure they agree.

For all Active Tagout Sheets, verify by visual inspection that all associated tags are in place, the component is in the proper position, and the tag is properly completed and signed. Any deficiencies must be resolved by preparing new tagouts/tags as required.

Upon completion of the audit, the OOC List/Tagout Index will be recopied to list only the active items. All Inactive Tagout Sheets and associated tags should then be discarded.

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Each Target Chamber is a confined space that requires special procedures to ensure safe entry. Additionally, radiation safety procedures must be followed to ensure the protection of personnel and to prevent the release and spread of radioactive contamination. (Note: Because the space can be maintained in a condition safe for entry by continuous forced air ventilation, it is not a "permit-required confined space" as defined by OSHA [see OSHA standard "Title 29 CFR Part 1910.146(b)"].) To ensure safety and controlled entry follow the procedures of the LLE Radiological Controls Manual (LLEINST 6610), Sec. 3008, for initial entry and closeout. For OMEGA EP also refer to S-AB-P-192 for entry.

**4007 Grating Compression Chamber Entry**

The Grating Compression Chamber (GCC) is a confined space that requires special procedures to ensure safe entry. Specifically, because it is a Class 100 clean space that contains very expensive optics, special care must be exercised by personnel who enter the GCC. Additionally, because it has free communication with the OMEGA target chamber, tritium contamination is possible. If radioactive contamination is expected, radiation safety procedures must be followed to ensure the protection of personnel and to prevent the release and spread of radioactive contamination. If no contamination above the limit is detected in the OMEGA to GCC vacuum tube, the GCC may be assumed to be uncontaminated. (Note: Because the space can be maintained in a condition safe for entry by free communication with the Laser Bay via the access door, it is not a "permit-required confined space" as defined by OSHA [see OSHA standard "Title 29 CFR Part 1910.146(b)"].) If radioactive contamination is suspected, follow the procedures of the LLE Radiological Controls Manual (LLEINST 6610), Sec. 3008, Target Chamber Entry, for initial entry and closeout.

**4008 Safety**

The safe operation of OMEGA, OMEGA EP, and the Cryogenic and Tritium Facility is of paramount importance and will not be jeopardized. It is the responsibility of all personnel to follow applicable safety procedures. The failure to follow established safety procedures may result in appropriate disciplinary action up to and including dismissal. Since general and specific safety precautions, procedures, laws, and regulations exist from several authoritative sources (e.g., University Environmental Health and Safety procedures, state and local electrical and mechanical codes, NYS laser and radiation safety regulations, Facility Manual Volumes II, V, and VIII, etc.), they will not be enumerated here.

The Laser Facility Manager and Cryogenic and Tritium Facility Manager have the overall responsibility for the safe operation of the Laser Facility and Cryogenic and Tritium Facility respectively under the general guidance and oversight of the Laboratory Safety Officer and the functional area safety officers (Chemical, Electrical, Laser, and Radiological). If a question arises with respect to safety, it should be resolved by referring to an authoritative reference before proceeding. Should situations arise where procedures are unknown or there are questions of interpretation, the appropriate

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functional area safety officer should be consulted before proceeding. These situations and questions will also be brought to the attention of the Laboratory Safety Officer before proceeding.

The following policies apply to safety throughout the Laboratory:

No person will willfully operate, energize, or otherwise use any tool, system, or equipment that is known to have a safety defect.

Only personnel who are specifically trained and qualified will perform system or equipment maintenance.

No personnel safety-related interlock, alarm, detector, or device will be overridden or disabled without the specific permission of the Laboratory Safety Officer.

Safety incidents and potentially unsafe practices or conditions will be reported immediately to the Shot Director/Cryogenic and Tritium Facility Manager who in turn will inform the Laser Facility Manager or Target Group Leader as applicable, the appropriated functional safety officer, and the Laboratory Safety Officer.

No person will intentionally allow him- or herself to be shocked by electricity, to inhale or eat hazardous chemicals or materials including radioactive material, to be exposed to laser radiation without appropriate protection, or to be exposed unnecessarily to nuclear radiation.

Appropriate safety protective equipment shall be worn when required. This includes appropriate goggles when exposed to laser light; safety glasses, rubber gloves, and laboratory aprons when handling hazardous chemicals or cryogenic fluids; safety glasses when operating machine tools such as grinders, drills, lathes, milling machines, etc.; safety shields and rubber gloves when working on energized power sources; and safety harnesses when working aloft, including the top of the GCC.

Systems and equipment shall be tagged out in accordance with Sec. 4005 as required.

Only personnel trained and certified to operate machine shop equipment by a full-time LLE machinist will operate such equipment.

All personnel will comply with the electrical and nitrogen safety procedures detailed below.

Outside normal working hours, at least two people using a "buddy" system must be present in the laser facility.

Motorized actuators/manipulators are not to be controlled via a connection outside OMEGA's firewall.

Electrical Safety Procedures: Electrical or electronic equipment containing >24 volts shall be de-energized prior to performing corrective maintenance. This does not apply to taking readings on, making adjustments to, or trouble shooting electrical or electronic equipment when by equipment or instrument probe design the readings and adjustments can be made without risk of electrical shock. A risk of electrical shock exists if it is possible to inadvertently contact a live electrical circuit. If there is risk of shock and it is

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necessary to take readings on or perform maintenance adjacent to energized components, then the following procedures for working on energized equipment must be followed:

Permission to work on energized equipment must be received by the cognizant Group Leader and the Laboratory Safety Officer or the Electrical Safety Officer.

The equipment should be de-energized to the maximum extent possible.

A minimum of two personnel must be present: one who is actually performing the maintenance and one who acts as a safety monitor.

Insulating material should be laid out to the maximum extent practical to insulate the worker from ground and to protect against inadvertent contact with energized components.

Approved insulated rubber gloves should be worn if practical.

The safety monitor must be knowledgeable. As a minimum he or she must know how to de-energize the equipment, be in a position to observe the worker, and be in a position to pull/push the worker free in the event he or she receives an electrical shock. Care should be exercised that the safety monitor is not shocked in the process of freeing a shock victim. To this end, a rope or belt or personal momentum should be used to free the victim.

Someone qualified in CPR should be available in the Laboratory.

Insulated tools and instruments should be used.

A voltage tester should be used to verify which circuits are energized and which are de-energized before commencing maintenance.

Nitrogen Environmental Safety: Spaces that are normally filled with nitrogen when in use, e.g., the large optic test facility, beam transport tubes, etc., may pose asphyxiation hazards if they are not properly vented/monitored. Normally for laser facility systems employing nitrogen, the process of venting or opening them will immediately cause a mixing of room air thereby ensuring sufficient oxygen. Additionally, since the volume of the space into which these systems are vented is so large (e.g., Laser Bay), its environment will be virtually unaffected. This was verified in the safety analysis of each system using nitrogen. However, to ensure safety, any space into which nitrogen is vented that can be occupied or any space that previously contained nitrogen that can be entered must be monitored for oxygen. The oxygen concentration of any occupied space must be verified to be >19.5%.

#### **4009 Communication Procedures**

The effective and safe operation of OMEGA or OMEGA EP requires that communications be concise, precise, and formal. This applies to all face-to-face, headset, or public address communications. To ensure effective communications, the following standardized procedures apply to all OMEGA operations:

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General

No informal or personal communications will be transmitted on headsets or the public address system.

Headsets will normally be worn by all watchstanders and Channel 1 should be the primary operations channel. The Shot Director (SD) may use the speaker at the SD station to allow Control Room visitors to monitor events.

Headset communications must be concise, precise, and formal and idle chatter should not occur. Do not interrupt communications in progress, unless you have an urgent communication affecting operations or safety.

For extended communications relative to troubleshooting, maintenance, or other less formal circumstances, a clear/dedicated channel should be used.

To minimize circuit noise, close your microphone when not in use.

To avoid confusion, first names are not to be used in formal communications; rather, watchstation titles should be used or, if not on watch, either the last or full name will be used with title (Dr., Mr., Ms.) if appropriate.

Standard Communication Procedures

All communications that are either directive in nature or allow action to be initiated shall consist of a *to/from address, message, and acknowledgment* as follows:

*To address*—the station to which the message is intended, e.g., "Drivers, Beamlines, Shot Director, etc."

*From address*—the station that originates the message. The *from address* is not used for public address system announcements or in other circumstances where the originator of the message is obvious and cannot be confused. For example, when the Shot Director communicates that he/she is ready for completion of the checklist, it is obvious that the Shot Director is the originator. Voice recognition may also make it obvious as to who the originator is, as long as the receiver both recognizes the voice AND has knowledge that the individual is currently assigned to the watchstation from which the communication originated. Both the voice and the authority to issue a directive must be clear (i.e., while a specific individual has authority when actually standing watch, that person does not have authority to issue a directive that changes system status when he/she is not on watch).

*Message*—the order or informational item to be communicated.

*Acknowledgment*—the affirmation that a message is received and understood.

- If the message is a directive that requires action—the message must be acknowledged by repeating back the message followed by stating your station title and "aye, understood, roger," or another clear affirmative word indicating understanding. If the repeat back is in error, the originator will state "wrong" and will repeat the entire message.

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- If the message is informational—the message need not be repeated back and may be acknowledged by simply stating your station title and “understood, aye, roger,” or other clear affirmative word indicating understanding.

The following standardized terminology will be used for all oral communications:

Written	Spoken
Shot Director	Shot Director
Principal Investigator	PI
Laser Driver Operator	Drivers or LDO
Laser Sources Operator	Sources or LSO
Laser Driver Technician	LDT
Laser Sources Technician Short Pulse	LST Short Pulse
Laser Sources Technician Long Pulse	LST Long Pulse
Beamline Operator	Beamlines or BO
IR-Alignment Laser Technician	IR-ALT
UV-Alignment Laser Technician	UV-ALT
Alignment Laser Technician	ALT
Amplifier Technician	AT
Power Conditioning Operator	Power Conditioning or PCO
Power Conditioning Technician	PCT
Experimental System Operator	Experimental or ESO
Experimental System Technician	EST
Experimental Cryogenic Technician	Cryo Tech
Laser Bay	Laser Bay
Target Bay	Target Bay
Capacitor Bay	Capacitor Bay
LaCave (OMEGA)	LaCave
Diagnostics Bay (EP)	Diagnostics Bay
Pulse Generation Room	PGR
Driver Equipment Room	DER
Sources Bay	Sources
Darkroom	Darkroom
Vacuum Pump Room	Pump Room
Fan Room	Fan Room
Control Room	Control Room
(the number) 0	Zero
Alphabet A-Z	Alpha, Bravo, Charlie, Delta, Echo, Foxtrot, Gulf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whiskey, X-ray, Yankee, Zulu (This phonetic alphabet need only be used when necessary to avoid confusion.)

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Equipment Nomenclature	Use Full Titles or Accepted Acronyms
e.g., Main Large-Aperture Ring Amplifier	Main LARA
Number 1 Spatial Filter Pump	Number One Spatial Filter Pump
To Start	Start
To Secure (Stop)	Secure
To Shut (Close)	Shut
To Open	Open

**NOTE:**

Many of the elements of the OMEGA system are designated by the "Stage, Cluster, Beam" convention, where

Stages are lettered A, B, ... F,

Clusters are numbered 1, 2, ... 6,

Beams are numbered 10–60.

The phonetic alphabet is generally used to convey the stage letter and the cluster, and beam designation is properly pronounced as an ordered pair; e.g., say "Foxtrot One One," not "eff eleven."

The following are several example communications [in the correct sequence: *to address/from address/message // acknowledgment* (items included in parentheses ( ) are optional in the circumstance portrayed)].

**NOTE:**

The acknowledgment must be a verbatim repeat back of the directive.

SD: "Drivers/(Shot Director) ready for checklist."

LDO: "Ready for checklist, Drivers Aye."

**NOTE:**

"Aye" is an affirmative statement that means understood. The words "understood" or "roger" may be used in lieu of "aye."

LDO: "Beamlines/(Drivers) SSD driver spots available."

BO: "SSD spot available, Beamlines aye."

BO: Drivers/(Beamline) finished with SSD spot."

LDO: "Finished with SSD spot, Drivers, aye."

PI: "Experimental/PI (or name) steer TIM one up one hundred microns."

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ESO: "Steer TIM One up one hundred microns, Experimental aye."

PCO: "PCT/(Power Conditioning)/safe PCU's Echo One Four and Foxtrot Three One."

PCT: "Safe PCU's Echo One Four and Foxtrot Three One, PCT, aye."

PCT: Power Conditioning/(PCT)/PCU's Echo One Four and Foxtrot Three One are safed."

PCO: PCU's Echo One Four and Foxtrot Three One are safed, Power Conditioning aye."

**Example of erroneous repeat back:** note the use of the word "**wrong**" and a complete repeat of the entire message.

PCO: "PCT/(Power Conditioning)/safe PCU Delta One Zero."

PCT: "Safe PCU Delta One One, PCT aye."

PCO: "**wrong**" PCT/(Power Conditioning)/safe PCU Delta One Zero."

PCT: "Safe PCU Delta One Zero, PCT aye."

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## Tagout Sheet

Tagout Number \_\_\_\_\_

System or equipment name \_\_\_\_\_

Reason for tagout \_\_\_\_\_

Post Test: \_\_\_\_\_

(provide brief description or enter "N/A")

Tag suffix (-A,-B,...)	Breaker, switch, or valve identification	Position	Tag Removed	Post Test
		O = open/off S = shut	Initials/Date/ Time*	Initials/Date/ Time

Tagout authorized by \_\_\_\_\_ /  
(Shot Director/Cryo & Tritium Facility Manager) (Time and Date)

Tags installed by \_\_\_\_\_ /  
(sign after installing) (Installer) (Time and Date)

Tagout cleared by\* \_\_\_\_\_ /  
(sign when all tags removed) (Remover) (Time and Date)

Restored to Commission \_\_\_\_\_ /  
(sign when post-test is complete) (Tester) (Time and Date)

\*Complete after removal and delivery of the removed tags to the Shot Director.

Figure IV-2

**4010 - Shot Request Forms and Administration**

Execution of effective and safe OMEGA and OMEGA EP shots requires complete specification of the laser and diagnostic configuration, extensive advance planning, and many hours of system preparation prior to and during the actual shot day. The Shot Request Form (SRF) for each shot is the primary vehicle for recording and communicating the specifications for a shot. Supplemental tools and forms are used in planning and communicating the sequencing of related shots referred to as campaigns.

The SRF is a database object that is created via inputs made at a web-based SRF user interface. This interface consists of a series of pages or screens called "forms" that collect information of various types. The forms include the following:

- General
  - PI's, campaign identification, planned date, planned order, ...
  - Shot scope: OMEGA only, EP only, joint shot.
- Drivers (OMEGA) – driver line(s), pulse shape, SSD modulation, timing
- Sources (EP) – one to four sources, pulse shape, duration, timing
- Beams (OMEGA) – groups defined by energy, pointing, focus, termination
- Beams (EP) – one to four beams, short/long pulse, energy, pointing, focus, termination
- Target diagnostics – specified via a hierarchical series of location and setup forms.

Each SRF is automatically assigned a unique, sequential, identifying number at the time it is created. Appropriate controls are applied to limit both read and write access to the records.

The SRF can be viewed or printed, in part or in whole, to provide a standard format for review and implementation. On shot day, SRF data values are also accessed directly by the OMEGA Control System and used to assist the operators in preparing for and executing the shot. Once an SRF has been used to specify a system shot, it is considered expended and will not be reused. The SRF data values are retained indefinitely. The SRF values, indexed by the unique identifying number, may be retrieved for data assessment and can be copied to create new SRF's.

The Principal Investigator (PI) has the primary responsibility for preparation and coordination of the Shot Request Forms that define the shots for which he/she is responsible.

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The SRF process may be initiated at any time. The key steps and milestones in the preparation and use of SRF's are as follows:

- Monday, two weeks prior to the planned shot week – The PI submits Shot Request Forms that define each unique shot configuration to LLE. This will precede and facilitate the “two-week briefing.”
- Monday, one week prior to the planned shot week – The PI submits final Shot Request Forms for all of the planned shots to the Laser Facility Manager. The Laser Facility Manager shall be notified of all subsequent changes.
- During the interval between submittal and shot day – Designated LLE personnel will review the SRF's and may edit/modify data values as required with the concurrence of the PI. Personnel authorized to edit/modify SRF's include diagnostic instruments specialists, the Laser Facility Manager, and the functional managers charged with implementing the necessary shot preparations.
- Shot Day – The PI shall inform the Shot Director of any change in the planned shot order.
- Pre-Shot – The Shot Director and designated system operators may modify SRF data values for the shot that is currently underway with the concurrence of the PI. These changes shall be for the purpose of dealing with situations or details that could not have been anticipated earlier. All such changes shall be implemented and verified prior to charging for the shot.
- Post-Shot – The authorized persons may edit the SRF data to capture the actual shot conditions for a limited period after the SRF has been used to specify a system shot. This shall be for the purpose of facilitating data interpretation or replication of the shot.